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TOTAL QUALITY MANAGEMENT

by

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Preface

I choose Total Quality Management (TQM) as a subject for my research paper because I believe strongly that good management is the key for success. Good resources under poor management lead to nothing. On the other hand, and strong management can achieve valuable outcome with low resources. I specifically choose TQM as a subject because it is one of the most modern management systems in the world. I will try to address TQM in simple terms so that it is understandable for readers, which have no background in TQM.

I would like to acknowledge the ACSC commandant, teachers, and administration for giving me the opportunity to come on this research, and for their help and support during the course. At the same time I wish to acknowledge the Air University librarians for offering the required references for my research.

I acknowledge and appreciate the strong and substantial helps which I received from my Research Faculty Advisor Major Yvan Boilard for his useful and timely guidance.

I hope this paper will be a successful step in the management field.

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Abstract

Management is one of the most important elements, which leads to organizational success. There are different kinds of methods, which are used to manage organizations. Many books address and explain management thoughts and ideas. Sometimes we confuse and ask ourselves what is the right way to manage and improve our work and organization.

Total Quality Management System (TQM) is an integrated management system. This system includes strong thoughts and ideas, and applies them to fit any organization (including military organizations). In this research I address the historical background of the TQM system, explain how this system has been developed and what are the main causes which lead to each development, until it has become integrated management system, I explain the TQM's principles, which we must consider in management implementation. Lastly, I explained examples of suitable tools, which we use in process improvement.

The most important point in this research is the TQM model, which is directly applicable in the military field because it concentrates on human resources, and improvements to other organizational resources. The TQM model includes principles and strategy in an integrated approach to improve product quality, reduce cost, and efforts, all of which are final goals of TQM.

There are many examples of TQM implementation in the military. Department of Defense (DOD) has many successful examples. There are many DOD organizations have received a number of awards for excellence (based on quality and management improvement). "In 1990

four DOD organizations received the President's Council on Management Improvement Awards''[1].

Notes

[1] Cletus F. Wise, Implementing Total Quality Management In The Department of Defense, Maxwell AFB, AL. Apr. 1991. P: 13.

Part 1

Quality

"Quality'' is one of the most important subjects in our lives because it is the basis for achieving our goals. Also, quality is considered an important force leading to organizational success.

Some people have the idea that an increase in quality always leads to corresponding increase in cost or decrease of production. On the contrary, correct application of the quality system leads to a reduction in cost and an increase the productivity while saving time and effort. People need quality in all directions and in all fields, products, services, information, and designs.

People are looking for quality in all directions. It is easy for them to achieve quality in their personal life but sometimes it is difficult to achieve it in their work. We can achieve quality not only in the civilian sector, but also in all military fields. To achieve quality we must understand the correct scientific meaning of the term. We must, also study the quality systems closely, analyze our work, then chose a suitable quality system for our work. This process is very important because it is the key to achieving high quality in addition to low cost and efforts. In this research paper, I will demonstrate how to achieve this goal by explaining how to apply the highest quality system, the Total Quality System (TQM).

The Meaning of Quality[1]

The word " Quality'' does not have the popular meaning of "Best'' in an abstract sense. It means the best for satisfying certain customer conditions. Customer conditions can be classified as:

1. The actual end-user
2. The selling price of the product or service

The two conditions are reflected in many additional products and service conditions:

- Specification of dimensions and operating characteristics
- Life and reliability objectives
- Safety requirements
- Relevant standards
- Engineering, manufacturing, and quality costs
- Production conditions
- Environmental and other side effects considerations, and
- Cost of customer operation and use.

Scientists have many definitions for quality. The first famous definition was written by Juran[2] who defined quality as "fitness for use,'' the second by Crosby [3] is "conformance to requirement,'' and the third, written by Edwards [4] is "Quality consists of the capacity to satisfy wants.'' The formal definition for quality is written in ISO 8402[5] as "the totality of features and characteristics of a product or service that bears on its ability to meet a stated or implied need.''

Notes

[1] Armand V. Feigenbaum - Total quality control, 3rd ed Edition - New York : McGraw-Hill, c1983.

[2] American scientist specialized in quality born in 1904.

[3] American scientist in quality, he had many famous books in quality field.

[4] American scientist born in 1990, he taught quality in Japan after WW II.

[5] ISO: International Organization for standardization, 8402 is the formal document issued by ISO for quality definitions.

Part 2

Quality Systems Development

People have known about quality systems for many years. The old concept of quality was the inspection. It has developed into quality control, quality assurance, and then finally in Total Quality Management systems. At each development quality system did not ignore previous concepts but rather included them.

Inspection

Inspection was the first quality concept. The inspection is a test to measure one or more functions of a product or service to ensure that it has the same characteristics and requirements that were sought by the designers. The inspection is very expensive because it is done at the end or during of the production process. The cost of the unconfirmed products increased the total cost. Because of additional labor hours and production time increased. The "inspection'' developed into the quality control system.

Quality Control System[1]

The quality control process consists of 4 steps:

1. Setting quality standards
2. Appraising conformance to these standards
3. Acting when the standards are exceeded, and
4. Planning for improvement in the standards.

Quality Assurance System

The quality control system deals with the product on the production line only, but there are other elements that affect the product quality. For this reason Quality Control was further developed to yield the Quality Assurance System, which deals with the following factors:

1. **Manpower**: all the employees who are involved in different processes which affect the final product.
2. **Machines**: all equipment and instruments, which are used in all processes to couple to the final product.
3. **Materials**: all raw materials (manufactured or bought) which are used in different processes of the organization.
4. **Methods**: the procedures, which are developed to organize the work, and the techniques, which are used in the production line.
5. **Measurements**: the tools that are used to identify the degrees and values of the products or processes.
6. **Environment**: all the elements that affect the work on the production lines and processes (lights, noise, and ventilation, etc.).

The most important characteristic of the Quality Assurance System is quality planning, such as (ISO) certificates.

Total Quality Management System (TQM)

The TQM system is the last iteration of the quality systems. It includes all the characteristics of the previous systems (inspection, quality control, and quality assurance) and becomes an agreed companywide and plantwide operating work structure. It is documented and integrated technical and managerial procedures for guiding the coordination of people, machines, and the information network of the company. In essence, it is the best and most practical way to assure customer quality satisfactions and economical cost.

Total quality system characteristics and activities are as follows:

1. Defined and specific quality policies and objectives
2. Strong customer orientation
3. Activities necessary to achieve quality policies and objectives
4. Organization-wide integration of the activities

5. Clear personal assignment for quality achievement
6. Specific vendor - control activities
7. Periodic audit of system activities
8. Positive preventive and corrective actions
9. Uses a balanced approach between the social (Human) system and technical system
10. Uses scientific methods for process improvement

Notes

[1] Armand V. Feigenbaum - Total quality control, 3rd ed Edition - New York : McGraw-Hill, c1983 – P: 73

Part 3

Examples of Scientific Tools Used in Process Improvement

Scientific measurements are very important in Total Quality Management implementation. They identify process data accurately, and analyze this which useful for early errors identification. They can also assist the designer in making the right design at the right time. There are many statistical tools used to measure the different processes.

It is very important to choose the right tool that fit a certain process. It is also important to train people how to use scientific tools skillfully. We can classify the scientific tools into four major branches. First, tools that are useful for planning and brain storming like the Shewhrt (Deming) Cycle. Secondly, tools used to analyze data, like Control Charts. Thirdly, tools useful to identify problems like the Cause and Effect Diagram, and lastly tools used for Bench Marking.

The Shewhrt (Deming) Cycle[1]

Shewhrt (Deming) Cycle is one of the most important and simple tools for planning. It is a cyclic process for planning and testing certain activities before full–scale implementation. We use this tool when we need to apply a new idea, to improve our work. It is useful and wise to test the new idea on small scale to identify any errors or mistakes, cost and benefit before full-scale implementation. This cycle consists of four simple steps: plan, do, check, and act.

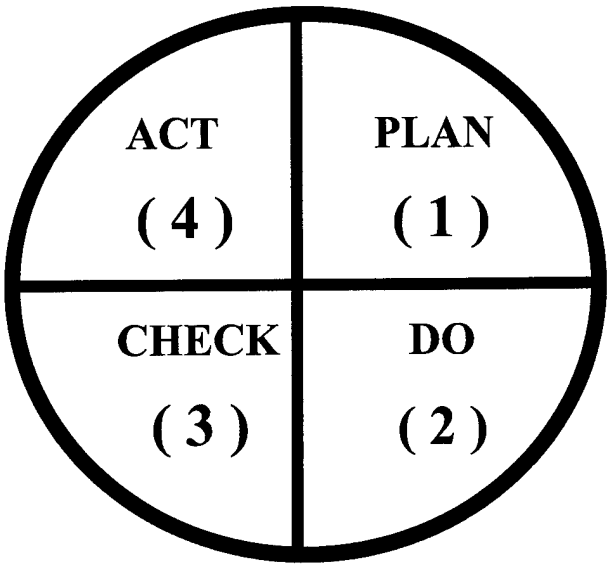

Figure 1. The Shewrt/Deming Cycle

Control Chart

The Control Chart is a graphical method to indicate the variation in a process to evaluate whether the process is or is not under control. The control chart has maximum upper and minimum lower limits, and an average limit for the process. When the band of usual variation is between upper and lower limits (situation 1); the process requires only preventive action. The process is considered out of control if the variations reach outside the upper or lower limit. In this event (situation 2), the process needs preventive and corrective actions. The following diagram is an example of a control chart for monthly flying hours of an airplane.

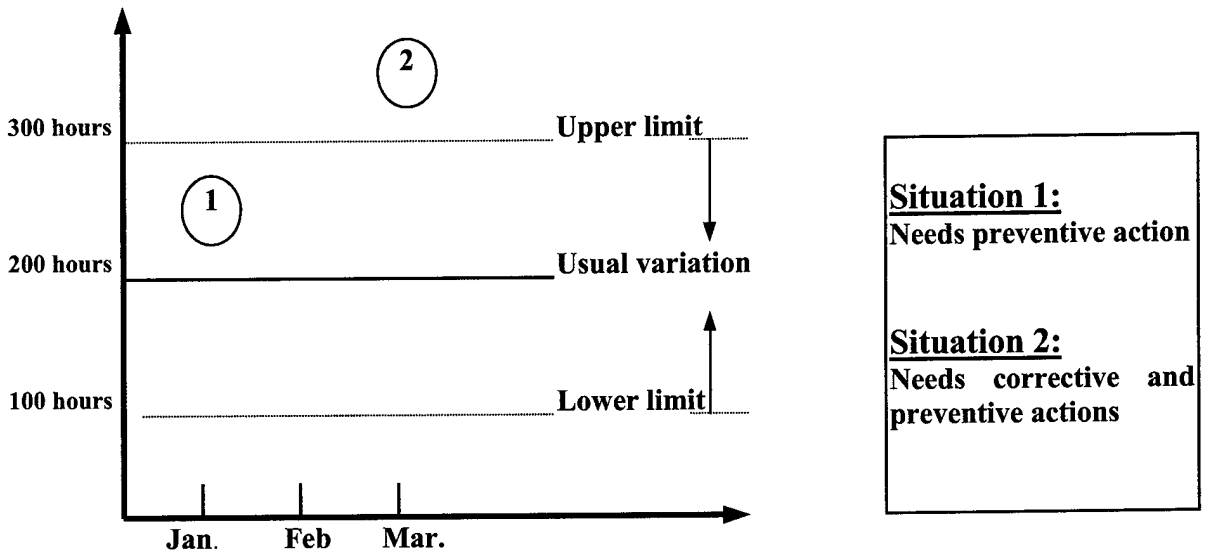

Figure 2. Control Chart.

Cause and Effect Diagram

A Cause and Effect diagram (sometimes called the Fishbone Diagram because it looks like the bones of a fish) helps us to understand the particulars a problem and the effect of each element. This diagram helps us to understand the relationship between the effect (problem) and its causes. To apply this diagram we must identify the major causes of the problem (for example: teachers, student, learning facilities, and classrooms are considered the major causes, which would affect a learning process). Brainstorming identifies the minor causes (details) which lead to the main cause. Each minor cause is only a sub-element of its major cause, and may be the main reason for the problem. The following diagram is an example of causal elements, which affect the learning process.

Bench Marking

Bench Marking is a process which measures our product (service—turning—design...) relative to its competition. This tool is very important as it allows us to measure success of our process relative to others. It is very helpful in identifying our weaknesses and strengths, so that we can plan for improvements. To use Bench Marking tool skillfully we must do the following steps:

1. Identify the similar process which has the same degree of interest in other organizations (we must ensure that they are similar).
2. Collect all suitable data about other process. We can collect data by many means (direct communication – meetings – conference – visits – media ...Etc.)
3. Analyze the collected data to identify credibility, value, and importance of each element. (We must do the same for our process).
4. Compare, evaluate, and grade each element in our process so that we can easily identify our process position relative to other processes (same –equal – lower). We can look for causes of weaknesses or strengths using other suitable tools (like the Cause and Effect diagram).

Notes

[1] United States. Dept. of Defense. Office of the Deputy Assistant secretary of defense for Total quality management, Total Quality Management Guide, Washington, D.C, 15 Feb 1990. – volume I - P: 70

Part 4

How We Apply the Total Quality Management System

The starting point for implementation of TQM is the most difficult step. There is not a constant strategy for implementation because each case has its own circumstances and unique strategy. Once we can identify the TQM strategy for our organization, we can also apply this TQM strategy through out the organization's general management. The TQM strategy must be very clear and known to the entire membership of the organization.

There are many examples for applying TQM strategy and how much benefit was obtained. One of the most famous examples was Ford Motor Company. Before TQM implementation, Ford had a normal management in their approach to quality. The company manufactured parts and products according to exact specifications, then used the inspections process to check unconfirmed products. There were no any processes improvement thus "for every dollars spent on preventing product defects/error, it cost 10 times as much to inspect products to catch defects/errors, and 100 times as much to recall/replace/correct,"[1] Ford company began to lose its share the market.

In 1981 Ford's manager invited Dr. Deming[2] (after hearing about his new management process). Ford started to apply TQM, and achieved rapid improvement. "In 5 years, warranty repair frequencies dropped by 45%, and (things gone wrong) reported by new car owners similarly decreased more than 50%. In the same period, Ford's share of the US market rose to

19.2%, the highest it had been in 5 years. There were record profits and operating cost were reduced to the point that Ford was spending $12 million less per day than it had 5 years earlier."[3]

We can learn from previous TQM implementation experiences that there is a general strategy for TQM, which we can use as guidance in all cases. The following are basic steps in the implementation of TQM.

General strategy elements for TQM implementation[4]

1. Form and build leadership for TQM implementation.
2. Build awareness of the TQM concepts.
3. Identify aims and strategic objectives for organization.
4. Establish and secure the communications inside the organization.
5. Choose early efforts in visible areas critical to success.
6. Build teamwork.
7. Provide support training and education.
8. Build trust and respect.
9. Create suitable environment and circumstances for process improvement.
10. Continuously improve all processes.

Form and build leadership for TQM implementation.

Effective TQM implementation depends strongly on the management and the management depends strongly on leadership. Leadership in the TQM system includes all leadership levels from the highest to the lowest level in the organization. A good leader who does the right actions encourages his followers to do their jobs correctly. He must demonstrate good integrity and main time a good reputation. This kind of leader is in the best position to apply the TQM system.

Build awareness with the TQM concepts

Building awareness with TQM is considered one of the most important steps for implementation. It is a continuous action, starting from the beginning and continues forever. If

can convince every person of the benefits of TQM implementation, they will be more receptive the TQM tools and the right ways to go about process improvement.

Identify aims and strategic objectives for organization:

Identifying the organization's objectives is the first step the leadership must take to begin TQM implementation. It is the leader's responsibility to concentrate all the efforts of his organization and guide those efforts toward clear organizational objectives. The organization's mission and policies must be written and announced to all members. Leaders should translate the organization's mission to long term plans and short-term plans strategic plans. Short-term plans are also important to achieving solving urgent problems Long-term plans are important to achieving the strategic objective of the organization.

Establishing and securing communications inside the organization:

Establishing and securing communications is one of the most important elements, of creating a successful environment in which to apply TQM. Leaders should establish open and free vertical and horizontal communications in the organization. The main concept for communications is achieving a common understanding between all levels. With effective communication an organization creates trust and effectively channels efforts to overcome any problem, and to improve different processes. Moreover, leaders must communicate visions to followers and explain the right ways to achieve the objectives.

Choose early efforts in visible areas critical to success:

Success or failure in beginning TQM implementation has great effect on the credibility of the implementation in the future. Implementation may have a good or bad effect on the rest of the organization. Therefore, it is very important for the leader to carefully choose the area for

primary implementation. It is important to choose the areas that have a high probability of success. It is not good to choose a large part of the organization to apply TQM because of the greater risk of failure in new processes in large groups.

Also, it is not good to choose a very small part of the organization because most people would not feel the improvements and the results of the TQM. Leaders should start TQM implementation on the area over which he has good control, starting at the highest levels and going down gradually to the next lower levels. It would be a big mistake to jump or skip any level because all levels should be improved. TQM implementation should flow from the top down.

Build teamwork:

Teamwork is the engine that moves process improvements. Teamwork is very important to unifying all efforts in the organization to achieve the required objectives. It depends on good cooperation between the members inside the team, as well as cooperation between the teams inside the organization.

There are many kinds of teams. For example, leaders can form a lateral communication team, which consists of members from all fields in the organization. There are also special teams, which can be formed to solve urgent problems. Leadership should create the suitable environment for the team to select team members and identifying a clear mission for the team. Most importantly leaders should train their team very well before giving them a job.

Provide support training and education:

TQM implementation depends on creating the suitable environment for people (individuals and groups) to improve processes and ideas. A key element in the progression of TQM is the improvement of the member's education and training. Organizations should establish education

programs. The programs should cover all the levels in the organization. Leaders who are qualified will incur the trust of their followers, which will, in turn, affect TQM implementation. To increase the qualification rate without putting an extra load on the employees, organizations should offer time and money for training and education and encourage people to pursue independent education.

Build trust and respect:

Trust and respect between employees and leadership, and also, between the team members themselves is one of the most important TQM's concepts. Trust and respect are essential elements to cooperation. Employees – in the TQM system - are not tools, but valuable resources and their organization. Any shortage in trust or respect will badly affect TQM implementation and will also affect employees' personalities and the organization's future.

Leaders can build trust and respect through strong channels of communications with their followers. Conversely, leaders should listen carefully for suggestions or ideas from their employees. As a mean to improve trust and respect leaders should share in the process improvement and encourage brain storming in all levels in the organization. If the employees identify any problem, leaders should publicly thank them. If the employees take part in solving a problem, leaders should increase their responsibility. If the employees fail to solve a problem, leaders should help them to succeed.

Create suitable environment and circumstances for process improvement:

Creating a suitable environment and circumstances for process improvement is the key to applying TQM. People are the most valuable source for ideas and creation in the organization, therefore, leaders should consider every suggestion they offer, especially those ideas that are easy and fast to apply. Process improvement must be made on the basis of correct data in

addition to ideas and suggestions. Continuous measurement of all activities is very important for improvement because measurement is the basis for knowing the improvement rate and making predictions. As I previously demonstrated leaders should choose the correct instrument to measure the process because there is no one instrument suitable for all processes.

Continuous improvement for all processes:

Continuous improvement for all processes is the main principle of the TQM system. It is also considered the main difference between the TQM system and the other systems (Quality control - Quality Assurance). The right amount of improvement for the organization elements will lead to organization's success. Therefore, leaders should check and review all policies, activities, and procedures to update them and make them fit TQM principles and concepts.

Notes

[1] Cletus F. Wise, Implementing Total Quality Management In The Department of Defense, Maxwell AFB, AL. Apr. 1991. P: 11.

[2] American scientist born in 1990, he taught quality in Japan after WW II.

[3] Cletus F. Wise, Implementing Total Quality Management In The Department of Defense, Maxwell AFB, AL. Apr. 1991. P: 12.

[4] Brian E. Mansir & Nicholas R. Schacht -Total Quality Management – A Guide to implementation – Bethesba, Md., August 1989.

Part 5

Total Quality Management Model

In this portion of my paper, I will apply TQM through certain models. The total quality model consists of predefined steps. Each step may have certain procedures, which must be followed to apply the total quality system. Although no specific model is suitable to fit all organizations or situations. There are some general models that can be used to implement total quality principles and general strategy. We can use these models and amend them according to the organization's specifications or the situation.

"The United States Air Force (USAF) logistic center at Warner Robins Air Force Base improved testing procedures of the C – 141 transport aircraft bleed air system while the aircraft was still disassembled, reducing defects from 73% to 11%. This reduced the aircraft delivery time by 3 days and saved approximately $9700 per aircraft reworked."[1] The example is one of the many successful TQM implementations in the military field.

Guiding Principles to Choose the Model

1. Simple models are easy to use, extremely effective, when applied correctly they can be very powerful.
2. Most organizations already have over 75% of the elements needed for successful implementation of a Total Quality Management model.
3. Successful Total Quality Management requires behavior and culture changes.
4. TQM implementation in military field requires a special model; it's a kind of model which must includes the human the organization. Both elements are considered the backbone in the military. The following model is very suitable to apply in military field because it concentrates on the organization and people simultaneously. It is also simple

to apply, and it does not need big changes in organization (big changes in military organization is difficult and needs a lot of approves, which might be a barrier to apply TQM). The Total Quality Management (TQM) model consists of two models; Organization Development (OD) and Human Resources Development (HRD). OD model and HRD model must be in balance; as shown in these simplified terms:

$$TQM = HRD + OD^{2}$$

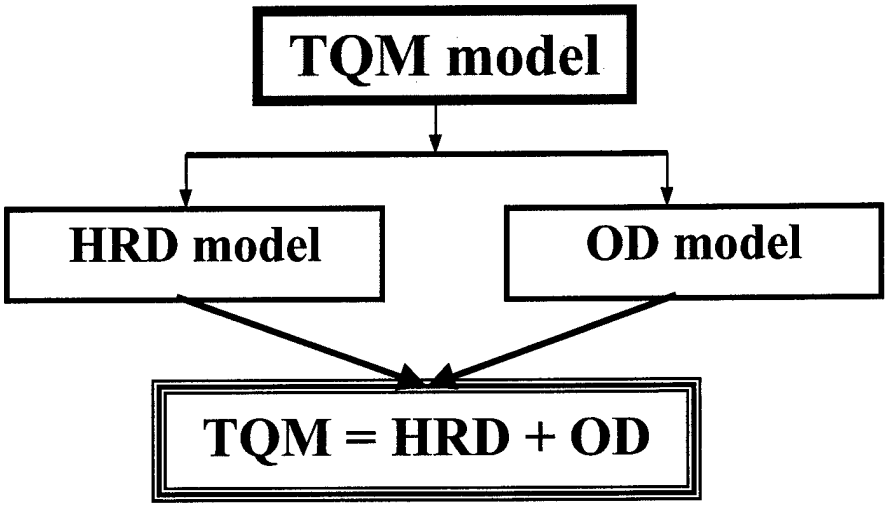

Figure 3. TQM model

Human Resources Development Model (HRD model)

This model helps leaders to put their thoughts and ideas to improve and develop the human resources in their organization. This model must integrate in balance with the Organization Development model to produce a vivacious TQM implementation. The Human Resources Development Model consists of three groups, leadership, workforce, and company.

LEADERSHIP: those responsible for direction, management and/or supervision, including owners, directors and officers.
WORKFORCE: All employees, including leaders, are part of the workforce.
COMPANY: All individuals or groups that consider themselves part of the company.

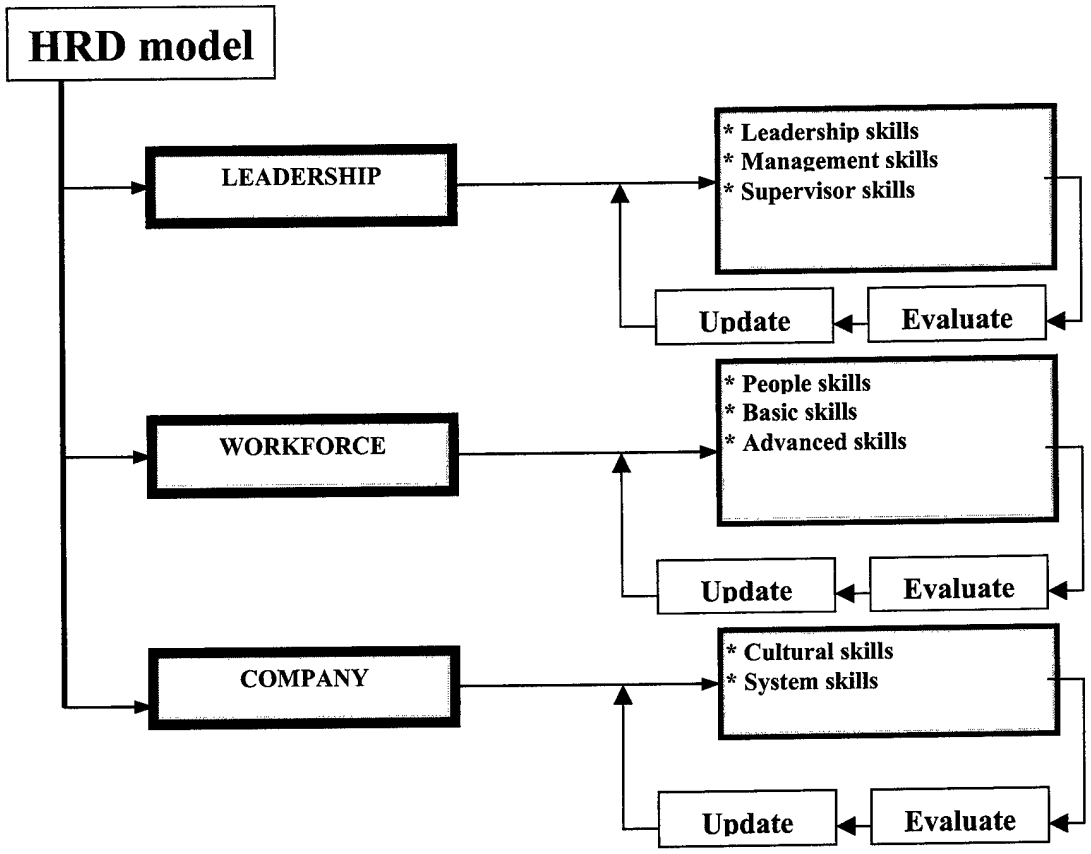

Figure 4. HRD Model

Organization Development Model Elements (OD MODEL)

Organization Development model is one of the two TQM models, which must be applied in balance with the Human Resources Development model. The OD Model consists of three elements, Organization, Workflow and Markets (Market –in the military field- this is represented by the effects the military has on its, and other societies). Each element has basic and specific questions about the organization. Leaders must answer each question to determine the weaknesses and strengths of their organization. Only then can they identify the areas for improvements. Leaders can use the suitable TQM tools to investigate their organization's activities, as demonstrated below:

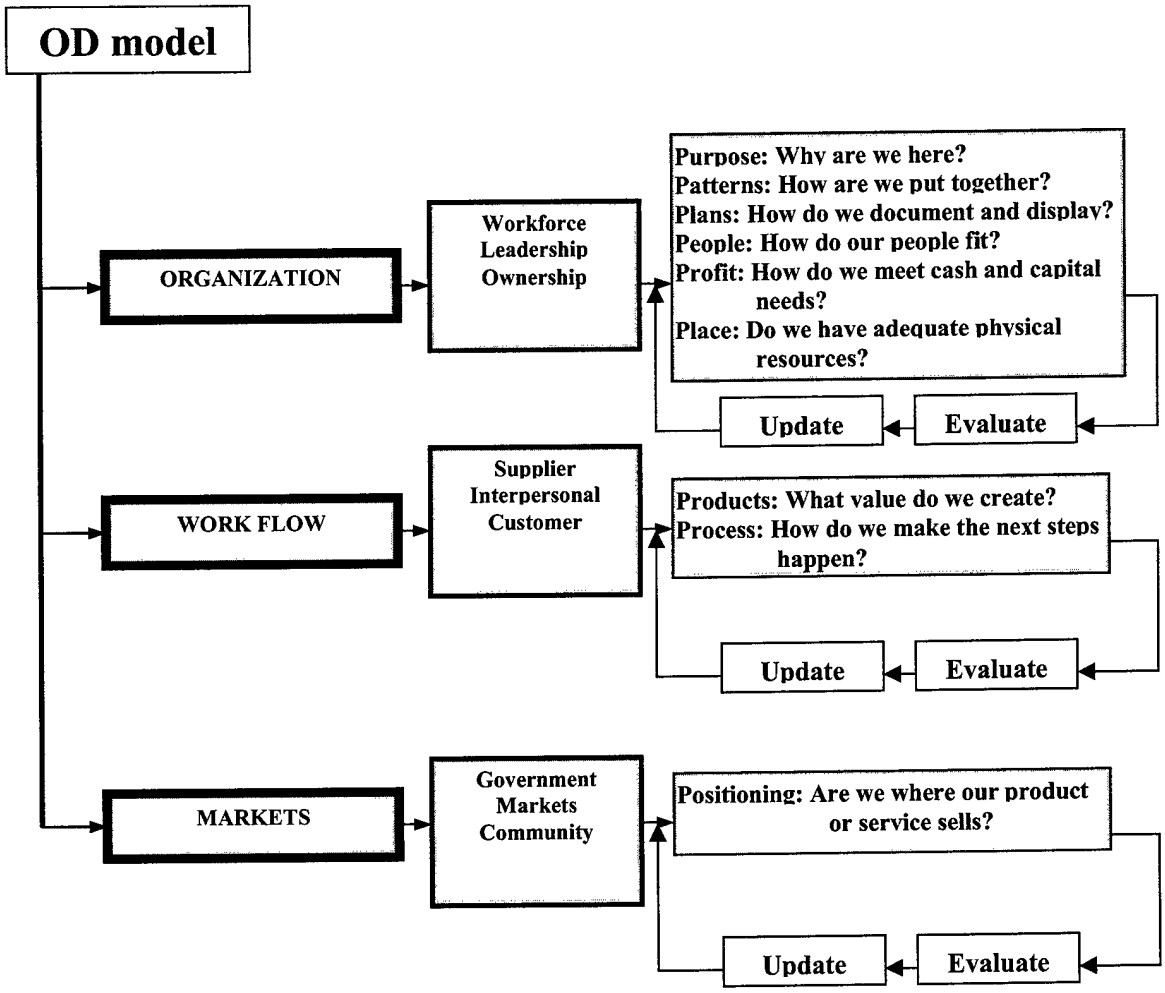

Figure 5. Organizational Development Model

Notes

[1] Cletus F. Wise, Implementing Total Quality Management In The Department of Defense, Maxwell AFB, AL. Apr. 1991. P: 16.

[2] The home page for leaders, on line, Internet, 13 February 2000, available from http://www.skyenet.net.

Part 6

Expected benefits from a Total Quality Management

Cost and production improvement benefits are key incentives for the implementation of TQM within organization and process. Benefits do not always mean more money also may include other elements like efforts and time. We also, can translate the amount of efforts and time into money. TQM system concentrates on maximize benefits and minimize costs and at the same time as it improves productivity. We must look at our organization's products and ensure that we apply the previous TQM concepts and principles (benefit – cost – product).

There are many military organizations achieved high benefit by applying TQM. A fist example: "Five AFLC medical treatment facilities have implemented TQM and report enhancements such as improved lab procedures saving $100,000 in Financial Year 1989 alone; reduced Pap smear screening backlog from 12 – 15 months to one month; and improved immunization and patient tracking."[1]

The second is one of the most important examples of TQM success in the operational military field. It concerns TQM implementation in F – 14 Tomcat fighter overhauls. They established two processes action teams (PATS) to apply TQM concepts. The final results "the cost of F-14 overhauls reduced by 44%, from $1.8 million to $1 million each; reduced average turnaround time from 202 days to 194 days while changing from three-shift to one shift operation; and reduced customer- reported defects by about two- thirds."[2]

The following elements are a guide, we should look for when determining how much improvement we achieved in our organizational processes.

1. Improvement in product quality
2. Improvement in product design
3. Improvement in production flow
4. Improvement in employee morale
5. Improvement in product service
6. Improvement in marketplace acceptance
7. Reductions in operating cost
8. Reductions in operating losses
9. Reductions in field service costs

Notes

[1] Cletus F. Wise, Implementing Total Quality Management In The Department of Defense, Maxwell AFB, AL. Apr. 1991. P: 16.

[2] Cletus F. Wise, Implementing Total Quality Management In The Department of Defense, Maxwell AFB, AL. Apr. 1991. P: 17.

Part 7

Conclusion

Quality is one of the main people's requirements for a sound and constantly improving organization. Quality systems were developed through time, with each new quality system including the previous. Amongst older quality system was Inspection, then it developed to Quality Control System, and Quality Assurance System. Total Quality Management (TQM) system is the most recent generation of the Quality systems. TQM system is a system for management that deals with all elements involved in the production. We can apply this system in many directions and in civilian and military fields.

There are many TQM's principles, but the most important principles of TQM are continuous improvement for all the processes. There is not a specific or fixed strategy to apply TQM system. TQM's general strategy is simple and effective because we can apply it through any organization's strategy. TQM system depends strongly on scientific tools, which are required for process improvement. Scientific tools are also very important for measurements, which are the cornerstone for TQM implementation. Scientific tools classified into tools useful for planing and brain storming like Shewhrt (Deming) Cycle, tools use to analyze data like Control Charts, tools useful to identify problems like Cause and Effect Diagram, and tools for Bench Marking.

We apply TQM system through TQM model, which must include the principles and general strategy of TQM. There is not a general model which fits all organizations and all kinds of

products, but we must study and analyze our organization and its product accurately, deeply, and carefully to choose the right model. As I explained in this paper TQM is a suitable model, which can be applied in any military organization, because it includes the human resources and the organization resources elements, and those elements are the main elements in the military field.

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